Non-isocyanate bio-based polyurethanes through reactive extrusion

Fiona Magliozzi[1, 2] *Etienne Grau*[1,2] *, Guillaume Chollet*[3]*, and Henri Cramail*[1,2]

Laboratoire de Chimie des Polymères Organiques (LCPO), CNRS UMR 5629, ENSCBP, Bordeaux

Polyurethanes (PUs) are specialty polymers found in many markets, such as coatings, paints, elastomers, adhesives and, of course, foams. Nonetheless, the current industrial pathway for the synthesis of conventional polyurethanes involves the use of toxic isocyanates to react with polyols.

The combination of fossil resources price variations together with environmental and health concerns pushes scientists to develop green chemistry strategies in the course of polymer synthesis. To that purpose, the development of bio-based monomers and the use of safe chemicals and processes are two main challenges that we tried to tackle in this study.

Indeed, among the routes to non-isocyanate PUs, the polyaddition between a bis-cyclic carbonate (bisCC) and a polyamine, leading to polyhydroxyurethanes, PHUs, bearing pendant hydroxyl groups linked to the polymer skeleton, is quite promising. Nevertheless, this pathway still presents some limitations such as a rather low reaction kinetics and the low PHUs' molecular weight generally obtained.[1,2,3]

Herein, the improvements brought by the reactive extrusion, in comparison to bulk conditions, with respect to PHU synthesis were investigated (Fig 1).

The efficiency and main features of this process towards PHUs synthesis, was investigated with different BisCC/diamines systems. The PHUs so-formed were characterized according to the conversion ratios, molar masses, thermal properties and the reaction time needed to reach those values. A comparison with bulk conditions will be presented.

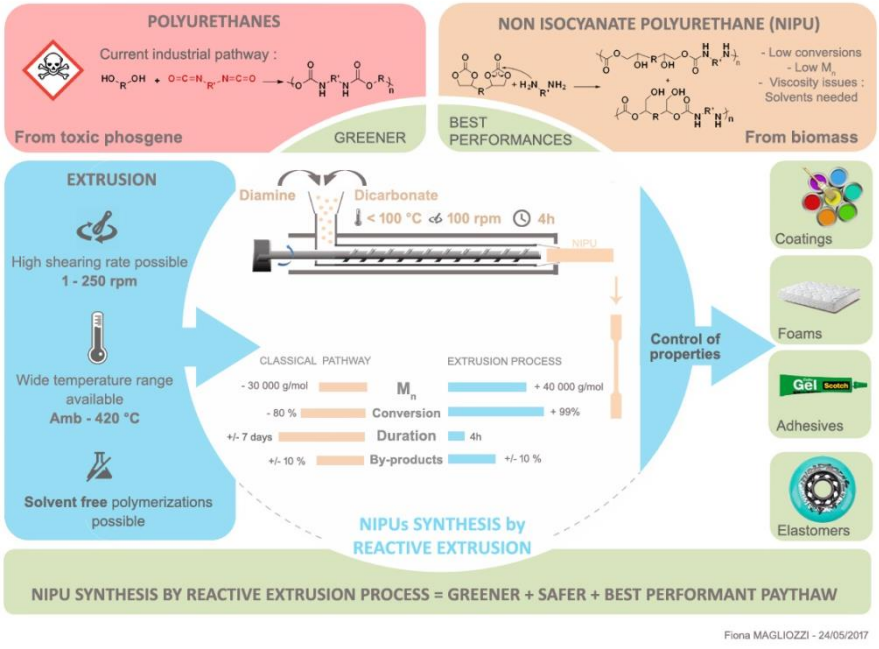

Figure 1 : Graphical abstract summarizing the purpose of the study

[1] *M.Blain, A.Cornille, B.Boutevin, R.Auvergne, D.Benazet, B.Andrioletti, S.Caillol J. APPL. POLYM. SCI,* ***2017***

[2] *L.Maisonneuve, O.Lamarzelle, E.Rix, E.Grau, and H.Cramail, Chem. Rev,* ***2015,*** *115, 12407−12439*

[3] *Juliën L.J. van Velthoven, Linda Gootjes, Daan S. van Es, Bart A.J. Noordover Jan Meuldijk Eur. Polym. J.* ***2015*** *70 125–135.*